



MINISTRY OF FUEL AND POWER

EXPLOSION AT LOUISA (including MORRISON OLD) COLLIERY, DURHAM REPORT

On the Causes of, and Circumstances attending,
the Explosion which occurred at Louisa (including
Morrison Old) Colliery, Durham, on the
22nd August, 1947

By R. YATES, D.S.O., M.C.
H.M. Deputy Chief Inspector of Mines

*Presented by the Minister of Fuel and Power to Parliament
by Command of His Majesty
March 1948*

LONDON
HIS MAJESTY'S STATIONERY OFFICE

PRICE 1S. 3d. NET

Cmd. 7347



MINISTRY OF FUEL AND POWER

EXPLOSION AT LOUISA (including MORRISON OLD) COLLIERY, DURHAM

REPORT

On the Causes of, and Circumstances attending,
the Explosion which occurred at Louisa (including
Morrison Old) Colliery, Durham, on the
22nd August, 1947

By R. YATES, D.S.O., M.C.

H.M. Deputy Chief Inspector of Mines

*Presented by the Minister of Fuel and Power to Parliament
by Command of His Majesty
March 1948*

LONDON
HIS MAJESTY'S STATIONERY OFFICE

PRICE 1S. 3d. NET

Cmd. 7347

TABLE OF CONTENTS

	<i>Page</i>
INTRODUCTION AND INQUEST	3
I. DESCRIPTION	3
General Supervision	4
Safety Lamps	4
Hutton Seam	5
II. FOURTH NORTH DISTRICT	5
Ventilation	6
Working Arrangements	6
Inspections on Day of Explosion	7
III. NARRATIVE OF THE EXPLOSION	8
Discovery and Rescue Work	8
Exploration of the District	9
Presence of firedamp	11
IV. CAUSE OF THE EXPLOSION	13
Conclusions	14
V. MATTERS ARISING OUT OF THE EXPLOSION	14
Coal Dust	14
Firedamp Detectors	16
Searching of Workmen	16
Ventilation Arrangements	17
VI. FINAL OBSERVATIONS AND RECOMMENDATIONS	18
Reference to Rescue Work	19
Acknowledgments	19
APPENDIX I—	
List of Casualties	20
APPENDIX II—	
Results of Analysis of Dust Samples collected after Explosion	20
PLAN No. 1. Workings in 4th North District in explosion area, with location plan of workings in Hutton Seam	In pocket
PLAN No. 2. Workings in 4th North District Area with workings of lower seams superimposed; and section of the seams	at back.

REPORT

On the Causes of, and Circumstances attending, the Explosion which occurred at Louisa (including Morrison Old) Colliery, Durham, on 22nd August, 1947.

21st February, 1948.

THE RT. HON. HUGH GAITSKELL, C.B.E., M.P.,
Minister of Fuel and Power,
7, Millbank, London, S.W.1.

SIR,

In accordance with instructions, I beg to submit my report on the circumstances of an explosion which occurred at Louisa (including Morrison Old) Colliery, Durham, when twenty-one persons lost their lives and three others were injured.

I attended the adjourned Inquest held before Mr. Wm. Carr, H.M. Coroner for the West Chester Ward of the County of Durham, sitting with a jury of nine men, which occupied two whole days. The Coroner gave every facility for calling and examining witnesses, and twenty-three were called by him at my request. It was agreed by all the parties represented that the Inquest had been thorough and exhaustive, and I would like here to express my thanks to the Coroner for his courtesy in this matter. He recorded the following verdict :—

“ In the case of the nineteen the cause of death was carbon monoxide poisoning and accidental death as a result of an explosion of methane and air at the Louisa Old Pit, and in the case of the two it was toxæmia and circulatory collapse due to burns accidentally sustained.”

The Foreman stated that the Jury found it had been established that matches and cigarettes had been found in the Morrison North Pit and that they would like the Press to make an appeal to the men who are carrying on these practices ; that they appreciate the difficulties of the deputies in searching men at the commencement of the shift, as those who are so inclined will find a way, but they think if there was more co-operation between the management and the men these practices would stop.

I—DESCRIPTION OF THE COLLIERY

Louisa (including Morrison Old) Colliery was formerly in the South Moor group of collieries belonging to the Holmside and South Moor Collieries Limited and is now in the “ C ” Group of No. 6 Area of the Northern Division of the National Coal Board. It is situated at South Moor, near Stanley, in North West Durham, and works the middle series of Durham seams, the Maudlin, Low Main and Hutton, in an area bounded on the West by the outcrop of these seams in the Lanchester district.

The upper seams in the same royalty, namely the Shield Row, Five Quarter and Main Coal, are worked from Hedley Colliery ; and both mines have a common centrally situated upcast shaft, Charley Fan Shaft, where an electrically driven Sirocco fan producing 175,000 cubic feet of air per minute at 2½ inches water gauge is situated.

The lower seams in the same area, namely the Towneley, Busty and Brockwell, are worked from Morrison Busty Colliery, which is a separate mine in the same group with its own upcast shaft and fan.

Louisa Colliery is served by three downcast shafts: Louisa, William and Morrison North, and employs in all 1,480 persons underground and 350 on the surface for an average daily output of 1,450 tons. All the output is wound at Louisa shaft apart from a certain amount of overflow coal at Morrison North shaft.

General Supervision. Many changes in the principal officials had been brought about following public ownership of the mines from 1st January last, and on 22nd August, the day of the explosion, they were comprised as follows:—

Mr. Wm. Welsh ...	...	No. 6 Area General Manager
Mr. G. H. Braithwaite ...	...	Agent, " C " Group
Mr. J. F. Meek ...	...	Manager, Louisa Colliery
Mr. R. Peel ...	...	Undermanager of Louisa and William Sections of Louisa Colliery
Mr. R. Simpson ...	...	Undermanager of Morrison North Section of Louisa Colliery

A third undermanager, Mr. E. W. Marshall, who was normally in charge of William Section and had been temporarily withdrawn to act as manager of another mine in the group, had acted as manager during the month of July, 1947, prior to which Mr. J. E. Bragan had been manager for four years; and Mr. Meek had been in charge from 1st August only.

Mr. Wm. Welsh was formerly chief mining engineer for the South Moor group: he was trained at these collieries and was manager at Louisa Colliery for some years, and he has an intimate and detailed knowledge of the underground workings and conditions. Mr. Braithwaite was appointed agent on 1st March last. Messrs. Marshall, Peel and Simpson had also been employed in the South Moor group for some years.

Each section of the colliery had its own complement of overmen covering the period from 3 a.m. to 11.30 p.m. daily, and the uncovered period of the night shift was under the sole charge of a master-shifter whose hours were from 10 p.m. to 6 a.m. On the Friday night in question, however, the fore shift overman, John Hutchinson, of the Louisa Section, had commenced his Saturday shift at 12 midnight in accordance with established routine, and he took an important part in the rescue operations, as will be described later.

Safety Lamps. Apart from the use of safety lamps as a precautionary measure inbye in certain districts (for a reason now unknown) in the Low Main and Hutton Seams, open lights were used up to 1941 in all seams down to and including the Hutton. During that year, following a suggestion by the then Divisional Inspector, who had drawn attention to the fact that workmen were hiding matches and other contraband on a main intake haulage road serving one of the safety lamp sections and had pointed out the fire hazard (a serious fire in the Low Main Seam in 1929 had been caused by an acetylene lamp), the Chief Mining Engineer, Mr. Wm. Welsh, decided to install safety lamps throughout the Louisa Old and William sections, excluding the Morrison North section of shallow work under more or less wet conditions approaching the outcrop. The full implications of safety lamps were accepted in these two areas in respect of searching persons, the application of Part II of the principal Explosives in Coal Mines Order, and the use of certified flame proof electrical apparatus and firedamp detectors.

It should be stated here that the 4th North District, which is within half a mile of the Morrison North shaft and over $1\frac{1}{2}$ miles from Louisa shaft, was formerly in the open light area of Morrison North, but in order to meet the workmen's claim that this district should be included in the Louisa Workmen's Lodge, it was placed under the jurisdiction of the Louisa Undermanager and worked with safety lamps.

Hutton Seam. The seam at this colliery averages $2\frac{1}{2}$ ft. in thickness, with a strong shale roof and a seggar floor. It has a volatile matter content on an ash-free dry basis of 33.7 per cent. and yields a high quality gas coal. It has been worked very extensively and little remains to be extracted in the royalty. The 4th North District comprises a small area of the seam sterilised by a fire in 1929 in the Low Main Seam lying 30 ft. above, which had necessitated the sealing off of a pillared area of about 100 acres in this upper seam. During 1944 the fire area was entered and new seals were erected nearer to the locus of the old fire. This made available for working the area of Hutton seam referred to above and the lower seams under the area to be worked from Morrison Busty Colliery. Plan No. 1 shows the position of the sealed area in relation to the 4th North District. There is no record of inflammable gas having been found in the seam prior to this explosion.

11—FOURTH NORTH DISTRICT

In this district the depth to the Hutton Seam is about 450 ft. and the general direction of full dip is 1 in 29 slightly south of east.

Plan No. 2 shows that the small area of solid coal to be worked was bounded on all four sides either by goaf or bord and pillar workings.

The area was entered at its north end by means of a 1 in 6 dip stone drift driven due east from the 4th North Low Main Haulage Road, and its continuation in the seam skirted whole workings on the north side. From this east heading a heading was driven southwards through the heart of the area and won out longwall faces to the east and west. By August, 1947, four conveyor faces had been worked to the west to a barrier line fixed to protect the 4th North Low Main Haulage Road; two conveyor faces had been worked up to and connected with the old Wembley gateway face; and two other faces, the Straight East and 2nd East, were being worked to the east. The Straight East face was the first conveyor face to be started in the district but it had been stopped in September, 1946, on account of very wet natural conditions and was not re-started until July, 1947, by which time it had become dry. To the south of the 2nd East face there were two tub gateway faces working the narrowing strip of coal between the 2nd East face and the barrier being left to support the Low Main Cross-cut Haulage Road to Louisa shaft.

All the coal in this district was hewed with air picks and shots had never been fired in the coal. Top rippings were shot down in all the roadways and the roof on the conveyor faces caved regularly between the gateside packs. All the conveyor machinery and a small hauler on the South Heading were electrically driven, but one small pump in the East Motor bord old right face was driven by compressed air. The two face conveyors were of the chain type: the Straight East conveyor delivering on to a chain conveyor in the gate, and the 2nd East conveyor on to a belt conveyor delivering into tubs on the South Heading. The tubs were hauled from both loading points by rope haulage. Chain conveyors had also been employed on Nos. 3, 4 and 5 old West bords.

Ventilation. The district was ventilated by a split from the 4th North Low Main Haulage Road leading from Morrison North shaft, and owing to its proximity to the upcast shaft the quantity of air passing was heavily regulated, (i) at the Wembley connection by a cloth fixed across a wood door which had been damaged by roof weighting, and (ii) on the North Heading return airway off the Straight East gate by the usual type of wood regulator door.

The quantity recorded on 18th August as entering the district was 9,040 cu. ft. per minute. The air was coursed by means of canvas cloths into the South Heading, up No. 1 West bord and then around the district, as shown on Plan No. 1. Roughly half this quantity was allowed to pass into the return at the Wembley connection, and the remainder (a measured quantity of 4,135 cu. ft.) ventilated the Straight East face and gate on its way out to the North Heading return airway.

No measurement had been taken of the air current at or near a point in the airway ten yards on the intake side of the first working place, as required by No. 6 (c) of the Coal Mines (Ventilation) General Regulations, 1947, but the quantity entering this return airway had been recorded on 18th August as being 4,820 cu. ft. per minute, which indicated little leakage through the heavy canvas cloth across the short length of the Straight East gate between the district main intake and the return airway.

I return to this matter later in this report, but it can be stated that the amount of air ventilating the district under normal conditions (with the canvas cloths in proper working order) was adequate.

Working Arrangements. The district was worked by a succession of shifts commencing at 3 a.m. on Monday and ending at 6.30 a.m. on Saturday in each week. Four shifts of workmen and three shifts of deputies (one on each shift in rotation) covered this period as follows:—

	<i>Workmen</i>	<i>Deputies</i>
Fore Shift ...	3 a.m. to 10.30 a.m.	2 a.m. to 10.30 a.m.
Back Shift ...	9.30 a.m. to 5 p.m.	10 a.m. to 6.30 p.m.
Third Shift ...	4 p.m. to 11.30 p.m.	—
Night Shift ...	10.0 p.m. to 5.30 a.m. and 11.0 p.m. to 6.30 a.m.	6 p.m. to 2.30 a.m.

The arrangement of work in the district was rather complicated. Coal was produced on all shifts except the night shift. On the Straight East face, 40 yards long, six hewers completed a daily advance at the face of about $4\frac{1}{2}$ ft. in one shift, which changed on a weekly rotation; and on the 2nd East face, 60 yards long, hewers were employed on the two other of the three coaling shifts. In the two tub gateways hewers were employed on all the three coal shifts. Conveyor movers and the conveyor gate canchmen came in on the shift immediately following the coal loading shifts, which meant they worked any of the four shifts in different weeks. On the night shift were employed the gateway canchmen, back canchmen and gate conveyor extenders, and men cleaning up spillage and stonedusting; while two stone drillers were usually employed between about 7 p.m. and 12 midnight. Since the introduction of the 5-day week some of the men normally employed on the Friday fore or back shifts were liable to be brought in at 11 o'clock the same night.

On Monday of each week the fore-shift deputy made a pre-shift inspection, after which work was continuous for the week and each of the three deputies made two during-shift inspections and entered a report on each during his shift. The overlap of the three shifts was sufficient to enable them to relieve each other at the meeting station in the district.

On Friday evening of each week the deputies came on shift earlier and on the day of the explosion, Friday, 22nd August, the back shift deputy was J. W. Maughan from 10 a.m. to 6.30 p.m. (as usual) and the night shift deputy was T. Hebden from 4 p.m. to 11.30 p.m. This deputy, however, reached the surface at Morrison North shaft at 11.20 p.m. and there met the fore shift deputy, John Estell (one of the victims), who should have descended at 11 p.m. Before he left the district Hebden arranged provisionally with a deputy in charge of another district to take charge if Estell eventually failed to turn up.

All the third shift had left at about the same time as deputy Hebden, and the persons on shift in the district about 11.55 p.m. when the explosion occurred were as follows :—

- (a) Two stone drillers, Johnson and Kilgallon, who had descended Louisa shaft and were admitted to the district by deputy Hebden at 7 p.m.
- (b) Men who had descended Morrison North shaft at 10 p.m. and were admitted to the district by Hebden at 10.20 p.m. :—

Three conveyor movers, Bell, Chapman and Fenwick : to advance the 2nd East face conveyor ;

Two stonemen, Appleby and Rowland : to take out a low girder on the South Heading outbye of 2nd East loading point ; and

Two other stonemen, Simpson and Brown : to continue a canch along the West face line towards the inbye tailgate.

- (c) Men who had descended at 11 p.m. and had reached their working places after deputy Hebden had left, probably before deputy Estell had arrived at the kist :—

Two stonemen, Bailey and Talbot : to renew a " warrick " girder near the outbye end of the Straight East loading gate ;

Two other stonemen, Minto and Westgarth : to complete the re-aligning of the Straight East gate conveyor and clean up ;

Three datal hands, Reed, Moore and Bell : to clean up on 2nd East loading gate ;

Three other datal hands, McKeever, Roe and Martin : to repair the rail track on the South Heading outbye the 2nd East loading point ; and

Four stonemen, Hodgson, Grimley and Rutherford, and Birtle : to canch the 2nd East loading gate, the 2nd East tailgate, and the inbye tub gateways respectively.

- (d) The deputy, Estell, who had reached the kist at the meeting station within a few minutes of the occurrence.

Four of the fourteen men who came on shift at 11 p.m. had already worked on the fore shift, and four others on the back shift, of the same day. There were thus eight additional persons to the normal night shift on shift at the time.

Each of these men carried an Edison " J " electric cap lamp. Deputy Estell also had his flame safety lamp, but none of the men carried a flame lamp gas detector, as required by the rule of the colliery. Deputy Hebden states that he reported this fact to Estell at the surface, but apparently Estell took no action in the matter and his flame lamp was the only gas detector in the district at the time of the explosion.

Inspections on Day of Explosion. On the fore shift of 22nd August, the day of the explosion, fore overman John Hutchinson had inspected the whole of the district, including the West face line, and had found the ventilation very satisfactory and free from firedamp.

Deputy Maughan found no firedamp during the back shift, nor did deputy Hebden on the third shift ; and overman T. Amos had also tested and found the face ripping lip of the Straight East gate clear as late as 10 p.m., two hours before the explosion occurred. Furthermore, as previously stated, there was no history of inflammable gas having been found in this district or in the Hutton Seam at this colliery. The two drillers who had left the inbye East faces about fifteen minutes before the explosion also stated that the conditions seemed to be normal at that time.

III—NARRATIVE OF THE EXPLOSION

The explosion occurred at 11.55 p.m. during the first and second hours of the fourth or night shift of Friday, 22nd August, 1947.

All the twenty-four persons at work in the district were involved : nineteen were found dead, and of the five recovered alive two subsequently died. None of the other 192 persons employed elsewhere in the mine at the time were affected. A full list of the casualties is given in Appendix I.

Discovery and Rescue Work. The first persons to raise the alarm and to reach the scene of the explosion were a party of three deputies, W. Younger, J. Shanley and Hy. Robinson, all trained rescue men, who were regularly employed in the adjacent fire area previously mentioned. This party usually carried a canary and flame lamp detectors, and they had with them a reviving apparatus for use in case of emergency. They had examined the fire stoppings alongside the 4th North Low Main Main Road on their way inbye from Morrison North shaft and had just reached their station in the fire area about 250 yards to the south of and beyond the offtakes for the 4th North District, when they felt a momentary cessation of the intake air, followed immediately by a rush of dust laden air coming in a normal direction from Morrison North shaft. This occurred at 11.55 p.m. according to Younger's watch. They realised fully what this denoted, and they picked up the canary and their flame lamps and ran northwards in the direction of the Morrison North shaft towards the seat of the trouble, which they soon discovered was in the 4th North District. Shanley then returned to the 4th Bankhead and telephoned this information to the surface, while Younger and Robinson entered the 4th North District, taking the canary with them. They went first into the Straight East gate through the heavy canvas cloth (which they state positively was intact), where they saw a light and heard moaning sounds ahead, and about thirty yards farther on they found one man (Minto) alive but unconscious and two others (Bailey and Talbot) apparently dead.

Robinson went back to the 4th North offtakes to telephone urgently for help and to get a stretcher for the injured man Minto, with whom Younger remained. It was then 12.20 a.m. by Younger's watch. Younger discovered that another of the men (Bailey) was alive, so he went to meet Robinson returning with the stretcher and sent him to fetch the reviving apparatus from the fire area. Robinson soon returned with Shanley and the fore-overman, John Hutchinson, who had descended Morrison North shaft at midnight and had been informed of Shanley's telephone message.

Younger and Shanley then recovered the three men in the Straight East gate, while Hutchinson and Robinson attempted to explore the South Heading, but the air was at that time too hot and thick with fumes to enable them to proceed very far. However, a little later on, and without effecting any repairs to canvas cloths, these four men were able to get along this Heading as far as the 2nd East loading point and up the 2nd East loading gate as far as the

face line. The cloths across the old East gate had been disarranged and the one across the 2nd East gate had been destroyed. They came across the two drillers, Johnson and Kilgallon, both alive but unconscious at the deputies' kist, and they brought them out to fresh air.

By the time the first rescue team arrived in the district, at about 1.30 a.m., these men had also recovered deputy Estell still alive at the kist and had brought out five dead bodies from the South Heading, and they had located four bodies in the 2nd East loading gate. An attempt was also made by them to get to the loading point on the Straight East gate, where they could see signs of fire, but the fumes were too heavy for them to make any progress. They were not at that time aware there were any men on the West side, but in any event the canvas cloth across the South Heading to divert the air current into No. 1 West bord had been destroyed and this side was consequently fouled with afterdamp.

About this time the Undermanager, Mr. Peel, arrived on the scene and took charge of the operations. Rescue teams quickly located the remaining bodies on the South Heading beyond the 2nd East loading point, on the 2nd East loading gate beyond the face line, and on the West side; while another rescue team entered the Straight East gate, where they came across Westgarth, with his clothing on fire, just beyond the loading point. Other clothing there and a wood chock carrying the conveyor gearhead were smouldering. They extinguished these incipient fires with sand and brought out the body of Westgarth, after which the fumes in the gate quickly dissipated.

There were no falls of ground seriously impeding the ventilation, which was speedily restored by re-erecting the cloths across the South Heading and the 2nd East loading gate and renewing those on the old East gates, and the remaining bodies were recovered without the aid of rescue apparatus.

The exact positions of the dead and injured persons when recovered are shown on Plan No. 1.

The clothing on the nineteen bodies was examined at the surface for contraband by a Police Inspector in the presence of an Inspector of Mines and representatives of the National Coal Board and the Miners' Lodge; and cigarettes and matches, including one pocket petrol lighter, were found on eight of them. I refer to this matter later in this report.

Exploration of the District. This was possible within a few hours of the explosion, at which time the Undermanager found a small accumulation of firedamp in a roof cavity at a 3 ft. fault at the roadhead of No. 4 West bord, which he describes as four per cent. at about one foot from the roof but which was not discernible in the general body of the air. This had dispersed by the following day.

It was soon evident that coal dust had played the major part in the explosion; indeed, in view of the amount of coking and of the previous history of the seam at this colliery, it was at first thought the explosion had been one of coal dust only and that firedamp had not entered into the matter at all. Investigation showed, however, there was no evidence that any preformed cloud of dust had been created at the outset or that there had been any igniting medium of sufficient intensity to initiate a coal dust explosion.

The details of the after-effects in the district are given on Plan No. 1, and the main indications of the passage of flame and blast are described below.

On the Straight East gate there was pronounced coking on the roof supports etc. from the roadhead back down the gate as far as the North Heading return airway, where the regulator door had been blown out. Minto, one of the

survivors, stated that he and his mate Westgarth had just reached the loading point, 30 yards back from the coal face, at the commencement of their shift and that they were undressing when he "heard a bang", but he cannot recollect anything more. He was found afterwards 50 yards outbye and near to two other men, Talbot and Bailey. These men had not arrived there when Minto first entered the gate with Westgarth and he cannot explain how he came to be found at this point afterwards.

There were no signs of coking along the Straight East face or along the old East face line but there were deposits of burnt dust, indicating the passage of flame, which increased progressively in amount as far as and into the old roadhead of the 2nd East gate. The only signs of force along this face line were the complete shattering of the regulator door at the Wembley connection and the displacement of roof baulks with a fall of roof about the old roadhead, through which there was still a good passageway for the air current.

The tailgate of the Straight East face was unaffected, but the old East Motor bord conveyor gate was heavily coked, especially about its centre.

On the 2nd East loading gate from the old roadhead the burnt dust deposit merged into coking up to about 20 yards inbye the 2nd East face line. From this point outbye to the South Heading there was increasingly heavy coking on the inbye side of the props, and the delivery end of the face conveyor was heavily coked. The canvas cloth across the outbye end of this gate had been destroyed and the conveyor motor gear, switches and cables had been blown across the South Heading into the mouth of No. 4 West bord opposite. The bodies of Moore, Reed and Bell (No. 1) were found alongside the gate conveyor on this road, and two of them were lying with their heads outbye as if they had been caught by a blast coming down the gate; and the body of Hodgson was found with both legs fractured beyond the 2nd East face line.

On the West side there was no sign of the passage of flame or blast in the inbye tail gate, where the bodies of Grimley, Rutherford and Birtle, face canchmen from the 2nd East side, were found; they had sustained no violence and death was due to carbon monoxide poisoning only. The first signs of coking were beyond the roof canch which Brown and Simpson were taking from No. 5 West bord towards the tail gate, and the body of Simpson was found with burning injuries farther outbye along the face line. Down No. 5 West bord there was coking on the face side of the timbers and in this gate was found the body of Brown, also with burning injuries.

In No. 4 West bord, which is opposite the 2nd East loading gate, there was coking on the east side of the timbers but no signs of violence. Outbye along the face line there was again heavy coking on the south side of the props and lighter coking along the incomplected new return airway and down No. 1 West bord almost to its junction with the South Heading. There was also considerable sooting and slight coking in the old No. 2 West bord (which had a dirt stopping at its inbye end), in which the deputies' kist was situated. Here two survivors, Johnson and Kilgallon, after having completed their shift drilling shotholes in the East gates, had been sitting for a few minutes talking to deputy Estell when they were "attacked by flame"; but neither of them can recollect anything afterwards.

On the South Heading there was very slight intermittent coking on both sides of the timbers from No. 1 to No. 5 West bords. Three empty tubs of a set standing on the landing opposite No. 1 West bord had been tipped over on their sides towards the east, long timbers in the mouth of No. 5 West bord had been blown out against full tubs standing on the heading and four of these tubs had been forced off the rails and partly tipped over towards

the east. The body of Chapman was found here in a crouching position facing outbye, crushed between one of the displaced tubs and the side and the bodies of his two mates, Fenwick and Bell (No. 2), were found a few yards outbye along the Heading. The driller Johnson recalls having passed these men on this part of the heading when he came outbye at the end of his shift; they had partly completed the advancing of the conveyor along the 2nd East face and it can only be conjectured what they were doing on the heading at this time. Johnson thought they were looking for timber. The bodies of Appleby and Rowland were found just outbye the 2nd East loading point and those of McKeever, Roe, and Martin about 30 yards outbye; all these men were lying as if they had been knocked down by an outward blast along the Heading.

The evidence was clear that the explosion had not traversed the 2nd East face or any part of the tub gateways or roadways at the inbye end of the South Heading. On the other hand it is significant that it had swept throughout all the conveyor roadways, both existing and disused (but still accessible).

The explosion had developed remarkably little violence, doubtless due to the relatively small quantity of combustible matter in the atmosphere, coupled with the absence of long lengths of roads along which pressure could build up and to the opportunity for dispersal of the force of an explosion, both in front of and behind the flame, provided by the South Heading and the West face line; and the comparatively slow travel of the flame had evidently caused the unusually extensive coking to be observed.

It is, I think, reasonable to deduce from this evidence that a mild firedamp explosion in which coal dust played no part at first had traversed the East face line between the Straight East loading gate and the 2nd East loading gate and had extended outbye along these gates and the intermediate East Motor bord, so as to open up several separate coal dust explosions; one in each of the gates. The most violent of these dust explosions occurred on the 2nd East loading gate and this erupted violently into the South Heading and continued up No. 4 West bord opposite to the West face line, where it spread leftwards as far as the tailgate and to the right down No. 1 West bord to the South Heading, and there died out.

The Presence of Firedamp. It is necessary at this stage to discuss how inflammable gas came to be present in dangerous quantity in the 4th North District, having regard to the previous history of the seam at the colliery.

There was subsequent evidence of the presence of firedamp on the West side in the roof cavity already mentioned; and on 27th August, five days later, Inspectors of Mines and the Undermanager found a larger accumulation at the roadhead corner of the inbye West tailgate, which tailed out some yards along the face line and down the gate. About three hours later it was found this gas had been dispersed by the normal air current, and an unsuccessful endeavour was made by short-circuiting the air to ascertain its actual point of issue.

In view of the proximity of old workings on all sides of the 4th North District any emission of gas from the Hutton Seam itself can, I consider, be ruled out; and the Low Main Seam 30 ft. above had been pillared in the area for over twenty years and any gas occluded in the strata above the Hutton Seam would have drained away during this period.

The suggestion was made by the workmen's representatives that combustible gas other than methane from the fire area in the Low Main Seam distilled by the heat inside the area now sealed, where the temperature is known to be still very high, had found its way through the strata below into the district.

This was extremely unlikely and moreover, Mr. E. W. Muddiman, Chief Scientist for No. 6 Area, was able to state positively at the Inquest that the air samples collected in the West tailgate on 27th August contained no combustible gas other than methane; which disposes of this theory.

This leaves only the strata below the Hutton Seam to be considered.

In considering possible reasons for the presence of an inflammable mixture of firedamp and air on the East face line and the Straight East gate, two important factors have to be taken into account :—

(1) The unsatisfactory arrangement of the single cloth across the outer end of the Straight East gate, on the short length separating the intake and return air at this rather vital point.

Any derangement of this cloth would allow intake air to short-circuit to the return and affect adversely the ventilating pressure creating circulation of air in this part of the district. Alternatively, a similar disturbance of the regulator cloth at the Wembly connection would have the same effect; and either or both of these events would considerably reduce the quantity of air coursing this part of the district and could even produce stagnation of the air.

There was no direct evidence of any failure of the ventilating arrangements, but they were sufficiently precarious to warrant being taken into consideration for this purpose.

(2) Disturbance of the strata below the Hutton Seam by abutment pressure brought about by the working of the lower seams, which can cause firedamp to be liberated from these seams or wastes and at the same time provide a relatively easy upward path for the gas—a not unknown occurrence at other mines in this country. There were no indications of floor breaks, apart from fault slips in the 4th North District, but it is the fact that water made in the Hutton Seam percolates through to the Towneley workings below.

In this particular area the Towneley Seam, 26 ins. thick and 55 yds. below, had been worked since 1946 and a longwall face was being advanced northwards; and the Bottom Busty Seam, 3 ft. 1 in. thick and a further 33 yds. below, had been worked in 1931 and again in 1946. There are also two thin unworked seams between the Busty and the Towneley Seam. A section of the seams is given on Plan No. 2.

The relative positions of the workings in the Hutton Seam and those of the two lower seams in the area are shown in Plan No. 2, from which it will be seen that those in the Towneley Seam had increased the span of the worked-out area from west to east and that a face advancing to the north was widening the span from south to north. At a certain stage in this expansion of the worked-out area an increased rate of general settlement was inevitable, and accompanying this there would be increased pressure at the abutments surrounding this area. These effects would be transmitted to the Busty Seam waste below. Furthermore, it will also be seen from the same plan that there had been an abutment in the Busty Seam from 1931 to 1946, which would have the effect of further disturbing the strata.

It seems probable that such action did occur and caused firedamp to issue from these lower seams and workings, and could account for the firedamp found on the West side after the explosion. The firedamp involved in the explosion may well have issued under the same influence on the East side, particularly where the various abutment pressures meet to the north of the Wembley return airway connection.

If this action caused only a very small rate of issue of firedamp of a few cubic feet per minute, which would not be detectable on the reduced flame of a safety lamp with the normal air current flowing, any interruption in the ventilating arrangements from one or other of the possible causes mentioned above (1) would in a comparatively short period bring about a firedamp-air mixture above the lower limit of inflammability in this part of the district.

I am not unmindful of the evidence that firedamp was found afterwards at two points on the West side before the ventilation was fully restored, but having regard to the fact there was something of the order of 9,000 cu. ft. of air per minute coursing this side and the inbye East side, it would be necessary to postulate a very high rate of emission of firedamp in this part of the district to bring about an explosive mixture in the air current—a most unlikely event in the circumstances. Any disturbance of the cloth on the Straight East gate would not affect seriously the amount of air coursing this part of the district, and any similar derangement of the cloth regulator at the Wembley connection would considerably increase this quantity.

I am therefore forced to the conclusion, in the absence of any other feasible explanation of the source and presence of this inflammable mixture on the East side, that the firedamp came from the lower workings and that the locus of the emission was on that part of the East face line immediately on the return side of the Wembley connection, where the area would be above the most intense abutment pressure zone in the Towneley Seam. The evidence of increased violence at this place indicates a richer inflammable mixture there.

The colliery records of air samples show that the Towneley Seam gives off firedamp but that it cannot be described as a gassy seam, although occasionally trouble is experienced with firedamp in the workings of this seam; the Busty Seam, on the other hand, is rather gassy.

The colliery barograph shows that for some days prior to, and at the time of, the explosion the barometer had stood at a consistently high level.

IV—CAUSE OF THE EXPLOSION

After the explosion a thorough search for contraband in the district was made by two Inspectors of Mines, accompanied by the Manager and Under-manager and two representatives of the workmen. Cigarettes, matches and one pocket petrol lighter were found, some in the pockets and clothing belonging to the persons killed in the explosion, some in tins hidden near the working places, 26 spent matches and three cigarette ends beneath and behind the deputies' kist, and other contraband lying exposed on the floor near the delivery end of the Straight East gate conveyor.

The points in the district where contraband was found are marked on Plan 1, and I have previously mentioned other contraband found in the clothing on some of the bodies examined at the surface.

The condition of the contraband found at the kist and in clothing and closed tins elsewhere did not indicate smoking on the night of the explosion at these points, but that found openly exposed in the Straight East gate was most significant. It consisted of two whole but slightly damaged cigarettes in an open and damaged cigarette case, three badly damaged cigarettes lying outside the case and a spent match, all lying close together in the full tub track near the loading point. A short distance away there was a whole cigarette which had not been lighted but had one end slightly damaged, as if it had been placed in the mouth ready for lighting. This, in my view, presents conclusive evidence that, in fact, a match was struck at this point immediately before the explosion occurred.

All other likely igniting causes of the explosion can be eliminated. No shotfiring was being carried on at the time ; in fact the exploder and shotfiring cable were found stored at the kist, and here the two drillers were discussing with deputy Estell the shots to be fired later by him, when the explosion occurred.

It is most unlikely that any of the electrical apparatus was in operation at the time. In any event it was all of certified type and a thorough examination by Mr. F. T. Hindley, H.M. Electrical Inspector of Mines, of all the equipment revealed no fault that could have been the igniting source ; and the signalling bells and telephone receivers, which were impounded and forwarded for test to the Ministry of Fuel and Power Research and Testing Branch at Sheffield, were also found to be in safe working order.

All the twenty-four cap lamps, and the one deputy's flame lamp, were also sent to the Testing Branch at Sheffield, and all but six of the cap lamps were found to be in good lighting order and safe. The damaged lamps were attached to men who had been subjected to violence on the 2nd East gate or the South Heading and the damage in each case was clearly due to the force of the explosion. The flame lamp was also found to be in safe working order, and ignition by any of these lamps can therefore be ruled out.

As it is known that under certain conditions it is possible to obtain sparking at a leaking compressed air joint or hose, the compressed air pump on the East face line and the pipe mains throughout the district were carefully tested and found to be in good order after the explosion.

Conclusions.

I have accordingly come to the conclusion that during the night shift of Friday, 22nd August, 1947, there was an emission of firedamp from the strata below the Hutton Seam, which created an inflammable mixture of firedamp and air on the East face line and the Straight East gate ; that shortly before midnight a lucifer match struck about the loading point on the Straight East gate for the purpose of lighting a cigarette ignited this mixture and initiated a very mild firedamp explosion, which developed additional force as it progressed and which was propagated by coal dust along the mechanised roadways, both existing and disused, throughout the district ; and that the explosion was finally extinguished by stonedust on the South Heading and the Main Drift.

V—MATTERS ARISING OUT OF THE EXPLOSION

Coal Dust. The Hutton Seam in the 4th North District is not a very dry and dusty seam, and wet conditions are met with at times, but the air picks used by the hewers produce coal dust, the finest of which is air-borne and deposited at the return ends of the faces, where the loading points in both conveyor gates were placed. This dust, added to that deposited during coal loading operations, would thus increase the difficulty of maintaining these places constantly in compliance with the Coal Dust General Regulations, 1939.

There was evidence to show that the management were alive to the importance of dealing with the coal dust at these points. On 16th August 40 bags (4 tons) of shale stonedust were spread in the district, and after the roadways had been cleaned up on the nights of the 19th and 20th August a further 40 bags of stonedust were spread throughout the roadways, including the two loading gates, on the following night of 21st August ; but it is to be noted that subsequent to the treatment the Straight East face had been worked on the first shift and the 2nd East face on the second and third shifts ; and the cleaners-up were just about commencing their work in both gates when the explosion occurred.

Four days after the explosion, nineteen samples of the dust on the roadways in the district were collected by an Inspector of Mines, and the details of the results of the analyses of these samples are given in Appendix II. Admittedly, in view of the blast which had swept the district these results do not represent the conditions obtaining before the explosion, but they do, in my view, give some indication that the floor of the conveyor roadways as a whole was in doubtful compliance with the Regulations at the time. However that may be, the disquieting fact remains that a coal dust explosion swept throughout all the existing and disused conveyor roadways in the district, with the contrasting difference that neither of the conveyor faces nor the hand-worked faces and roadways were affected; and this exemplifies the additional hazard from coal-dust brought about by mechanised mining.

Furthermore, a sample of the coal dust ground from the Hutton Seam was found on test for inflammability at the Research and Testing Branch at Sheffield to require 69 per cent. total incombustible matter content to prevent inflammation, as compared with the 65 per cent. minimum required for this seam by the Regulations.

The stonedust in use was ground at the colliery from shale from the underground workings and a sample tested at Sheffield for fractionation and dispersability was found satisfactory. In my view the evidence shows this stonedust had functioned satisfactorily in arresting the explosion.

The accumulations of dust apparently rich in coaly matter found on the floor after the explosion in all the disused conveyor gates indicate that these roads should have been cleaned up more thoroughly. In this connection I would point out that No. 3 of the Coal Dust Regulations 1939, in requiring the taking of such measures "for the prevention, suppression, collection and removal of coal dust and for treating it with incombustible dust or in any other manner approved" includes "every road or part of a road which is accessible"; and that No. 7, in calling for the systematic clearing of the dust on the floor of every conveyor road, includes "the space beneath the conveyor".

The arrangements in respect of frequency of treatment in the 4th North District of the working roadways in the district were good up to a point, but it may well have been (and I think it probably was the case) that after two coaling shifts had been worked there since it had been last treated the 2nd East gate was not up to the required standard.

Dust sampling had been carried out in accordance with the Coal Dust Regulations, but monthly sampling on conveyor roadways, especially in the vicinity of the loading point, where the conditions can deteriorate considerably in the course of a loading shift, clearly gives no real guide to the position in respect of coal dust.

Under the existing Regulations conveyor roadways are not necessarily sampled each calendar month; and therefore, in effect, treatment is decided on the result of a visual inspection. It is true that in many instances where very dusty conditions prevail the treatment is systematic, but this may well not be sufficient, and managers should make it a rule to have these roadways sampled at very frequent intervals to provide themselves with a truer picture of the position and so enable them to decide on the extent and frequency of treatment necessary to ensure compliance at all times with the Regulations.

In this connection, however, it is necessary to point out the danger of exposed layers of coal dust. Experiments carried out at the Research and Testing Branch with a highly inflammable coal dust (similar to the Hutton Seam) have established that a mild explosion, initiated by an igniting source of low violence—the conditions which obtained in this explosion—may be propagated by a coal dust which it raises from a surface layer only 4/100ths

of an inch thick, even where the coal dust rests on a stone dust deposit nine times its own weight ; and this result was obtained on separate tests with three different types of stone dust. This danger can only be countered by the frequent application of stone dust in small amounts.

There is no immediate remedy other than the continual cleaning up and application of stonedust at these places, except that the amount of breakage and spillage of the coal while being conveyed and transferred should be reduced to a minimum ; and shrouding the delivery and transfer points, and the use of water sprays, should be adopted more generally.

But there is no doubt that the only solution (known at present) to the problem lies in the application of water for the suppression of coal dust at the source : either in the form of infusion of the coal face, wet cutting or spraying ; including, where used, the fitting of water feed to air picks, which is now a practicable proposition.

The chain type of conveyor used in 4th North District undoubtedly created additional coal dust, due to the grinding action of the chain on the conveyor pans and to the escape at the pan joints of some of the dust on to the roadways.

Firedamp Detectors. I have already mentioned that there were no firedamp detectors other than the deputy's oil lamp in the 4th North District on the shift of the explosion. Safety lamps were not required in any of the seams at this mine by virtue of Section 32 (1) (a) of the Coal Mines Act, and detectors of the automatic type were not in use, but the other requirements of the Coal Mines General Regulations (Firedamp Detectors) 1939 were applied to both safety lamp sections and to the 4th North District, which, it should be recalled, was in the open light section of Morrison North ; and high candle power flame safety lamps were carried in addition as gas detectors by appointed workmen in the proportion laid down by these Regulations.

It has been an instruction for some years past at this mine for each deputy to record the names on his statutory report of all persons carrying gas detectors, and as far as the matter can be checked up with the lamproom records this rule was carried out generally, including the 4th North District.

I am not able to account for the apparently strange coincidence that none of the men had gas detectors in this district at the time, but it may well be not unconnected with the earlier and varying times of the commencement of the night shift on Fridays and with deputy Estell's late arrival on duty. The lampman on shift had apparently without question given the workmen the only type of lamp they had asked for. Minto, a survivor working in the Straight East gate, states that his mate Westgarth had a flame lamp on the back shift, but he could not say why he had not brought one on the night shift.

However, careful observation for firedamp seems hardly consistent with promiscuous smoking and I think it unlikely that the presence of gas detectors in the district would have obviated the explosion.

One of the workmen appointed to use a gas detector stated at the Inquest that he had seen diagrams of gas caps but had never seen a real gas cap. Mr. Vernon Richards, Workmen's Inspector, suggested that as far as possible arrangements should be made to enable these persons to see a real firedamp cap in the pit on a reduced flame. This may not be practicable in some instances, but more might be done in this direction with advantage, and I commend the suggestion to managers.

Searching of Workmen. It is doubtful if safety lamps were legally required in any part of this mine, but in any event Section 35 of the Act was applied

in its entirety to all sections or districts in which safety lamps were in use, including the 4th North District, as a voluntary precaution by the management ; and the standard selective system, with a quarterly general search (which was last carried out throughout the mine on 28th July), had been in force since 1941.

The general arrangements for searching have since been checked and found satisfactory but the usual complications arising from " mixed " lights were present in respect of the Morrison North shaft, where the 4th North District workmen using safety lamps intermingled with other workmen of the open light areas. This difficulty was overcome by fixing warning notice boards along the haulage road leading to the 4th North District, beyond which open lights and contraband were prohibited, and many of the workmen were searched at this point by the overmen, who were responsible generally for searching all the main shifts of workmen at the mine ; but owing to continuous working and the different times of commencement of the shifts in this district from the normal working shifts elsewhere overmen were not always available at this point, and the deputies' kist was regarded as the main searching station for the 4th North District. Here a selection of the men were searched by the deputy on shift, who admitted them to their work and who recorded on his statutory report the number of persons he had searched.

Following an explosion of firedamp at Watergate Colliery, Durham, on 3rd July last, involving two lives and due to illegal smoking, the Group Agent had impressed on all his managers the need for thorough searching, and this in turn was stressed with the officials and the deputies, but the amount of contraband found after the explosion proves how futile and ineffective the method of searching was, at any rate on this night shift in the 4th North District. Two of the victims whom deputy Hebden stated he had searched at the kist were afterwards found to have contraband on them. It can only be concluded that some members of the night shift were in the habit of smoking at their place of work and that the deputies must have been aware of this ; in fact, the finding of so many spent matches at their kist suggests that they themselves were guilty of this practice. Furthermore, it is difficult to see how the overmen concerned could have failed to detect smoking carried on to such an extent. The fact, however, that spent matches had been replaced in some of the tins of contraband indicates that some of the men, at any rate, had been careful not to leave any evidence of smoking behind.

The method of searching was clearly much too perfunctory in respect of the 4th North district, but admittedly no degree of searching can be really effective without the co-operation of the workmen concerned. In this instance it is difficult to avoid drawing the conclusion that there was connivance in this matter of smoking between the deputies and the workmen. It is, I am afraid, not unlikely that the under-officials, who would be fully aware the district was on safety lamps for a reason not connected with safety, failed to do their part in stamping out the natural tendency to smoke of workmen used to open light conditions.

This deplorable state of things was certainly not consistent with the high standard of safety and discipline which has always been the aim of the management of this group, and I attribute this lack of discipline in the 4th North District revealed by the explosion to have been a consequential effect of " mixed light " conditions.

Ventilation arrangements. The single cloth on the Straight East gate to separate the main intake from the North Heading return airway was bad practice and not in compliance with No. 10 (1) (b) of the new Ventilation General

Regulations which came into force on 1st August last. Arrangements for splitting the air were practically completed and this would have cut out the North Heading as an airway, but owing to its proximity to the main intake this connection with the return airway should have been dispensed with at a much earlier stage in the development of the district. It is true the Wembley connection had, meanwhile, established the ventilation of the 2nd East face and the other inbye faces but it had the effect of placing the Straight East between two very heavily regulated airways and any disturbance of the cloth would therefore have a more serious effect on the ventilation of this part of the district; and I do not think this aspect of the position was fully realised by the officials. Admittedly, the cloth was found apparently unaffected by the explosion, but nevertheless, I consider that it may well have had some bearing on the occurrence of firedamp in this part of the district. The uncertain character of the regulating arrangement at the Wembley connection is also open to criticism.

The availability of an abundant supply of fresh air (due to the proximity of the district to the upcast shaft) doubtless accounted for the fact that canvas cloths only were in use for coursing the air current around the district.

VI—FINAL OBSERVATIONS AND RECOMMENDATIONS

(1) The disquieting feature of this explosion was the ready propagation of the flame by coal dust along roadways on which conveyors had either been used or were in use, and there seems little doubt from the evidence left by the explosion that after having been initiated by firedamp it received its main "kick-off" by a coal dust explosion about the loading point on the 2nd East gate.

The treatment of coal dust on conveyor roadways in seams where the coal is friable and the natural conditions are dry, so maintained as to be *at all times* in compliance with the Coal Dust Regulations, is admittedly a difficult problem and one for which, as I have already stated, the only effective remedy is prevention of dust at the source by means of water. I therefore recommend that more active steps should be taken at the more dusty collieries to adopt this method in one or more of its different forms at the coal face.

These measures are now being taken at many collieries, more especially in South Wales, in an endeavour to reduce the hazard from pneumokoniosis, and in curtailing the explosion hazard from coal dust they serve a dual purpose in health and safety.

(2) The danger from coal dust on disused roadways was demonstrated by this explosion and I would stress the necessity for adequate treatment of such roads so long as they remain accessible, as required by the Coal Dust Regulations; and that when these roads become untravellable they should either be sealed off or otherwise protected by a substantial barrage of stone dust at each end.

(3) In view of the increased hazard from coal dust brought about by mechanised mining, I further recommend that in respect of No. 10 of the Coal Dust Regulations the Modification Order of 1939 made under the Defence Regulations, 1939, be revoked to allow the minimum percentages of incombustible matter laid down by the Schedule to Regulation 3 to have full application in the case of coals having a volatile matter content exceeding 27 per cent.

(4) The igniting cause of this explosion can, in the last analysis, be attributed to "mixed light" conditions, and I recommend that unless the different sections of workmen are completely segregated from the surface inbye the use of open lights should be prohibited in any mine where safety lamps have been introduced into any part (other than as a temporary precaution).

(5) The potential danger of an emission of firedamp from the intervening strata due to the concurrent working of a lower seam or seams needs to be emphasised and a careful watch should be kept for such a contingency, especially in that part of the workings overlying the abutment areas of coal ribs in the lower working, to enable suitable precautions to be taken in time.

(6) I consider it expedient that the searching of persons for contraband should be made compulsory in all mines or parts of mines in which safety lamps are used, whether or not they are required by the Coal Mines Act, 1911.

(7) Lastly, the question of inculcating a safety lamp outlook amongst the miners of North West and Mid Durham in particular remains to be tackled. Many of these men have at some time or other worked under open light conditions, and following a change of mine or the later adoption of safety lamps at mines previously on open lights, they find it difficult to give up old and ingrained habits of smoking while at work; hence their apparent indifference to, and disregard of, rules prohibiting the taking of contraband below ground.

It is a sad reflection on Durham that four explosions of firedamp, each involving loss of life, which have occurred in the county during the past eighteen months have been due to contraband; and in the case of a fifth explosion, in 1944, probably due to sparking at coal face switchgear, contraband was found on the body of the victim.

I am well aware this question of contraband has exercised the minds of the representatives of the workmen for some time, but I suggest they should intensify their efforts to overcome the apathy of many of their members to this menace to the safety of the Durham mines.

It is fitting to conclude this Report with a reference to the excellent work done by the three deputies Younger, Shanley and Robinson, and Overman Hutchinson, immediately after the explosion. These men were called upon to take what, in the circumstances, might be described as a judicious risk of a further explosion, and they acted with commendable promptitude and courage, and displayed great resourcefulness and circumspection. At no time were they tempted to do anything foolhardy, and it is to their great credit that not only did they discover and bring out to fresh air five badly injured men and ensure prompt first-aid attention to them but they also satisfied themselves at an early stage there were no other persons remaining alive in the district. High tributes to their conduct were paid at the Inquest by the Coroner and all the representatives of the various parties. The National Coal Board have formally recommended that recognition be given to these men for their work, and a case is now being prepared by the Divisional Inspector for your consideration.

I desire to express my thanks to the local Mines Inspectorate and the staff of the Research and Testing Branch for their valuable assistance; and to the National Coal Board and the representatives of the officials, deputies and workmen for their helpfulness during my investigation. I would also like to express my appreciation and thanks to the National Coal Board for the excellent plans prepared by Mr. S. Bott and his surveying staff, which were a feature of the Inquest.

I have the honour to be, Sir,

Your obedient Servant,

R. YATES.

APPENDIX I

LIST OF CASUALTIES.

	Name	Age	Occupation
KILLED			
1	Harold Talbot	34	Stoneman
2	Alfred Bailey	49	Stoneman
3	Edmund Westgarth	39	Stoneman
4	John Estell	38	Deputy
5	Thomas McKeever	46	Datal Hand
6	Walter Roe	18	Datal Hand
7	Francis E. Martin	21	Datal Hand
8	Thomas W. Appleby	45	Stoneman
9	John Rowland	54	Stoneman
10	Gerald Moore	21	Datal Hand
11	William Reed	37	Datal Hand
12	Thomas Bell (No. 1)	41	Datal Hand
13	Joseph S. Hodgson	28	Stoneman
14	Thomas Bell (No. 2)	49	Conveyor Mover
15	Norman Fenwick	32	Conveyor Mover
16	Joseph Chapman	37	Conveyor Mover
17	Colin Simpson	39	Stoneman
18	Reginald L. Brown	32	Stoneman
19	John Grimley	41	Stoneman
20	William Rutherford	32	Stoneman
21	Robert W. Birtle	27	Stoneman
INJURED			
1	Clement Minto	42	Stoneman
2	William H. Johnson	40	Driller
3	James Killgallon	40	Driller

APPENDIX II

SAMPLES OF MINE DUST COLLECTED IN 4TH NORTH DISTRICT ON 26TH AUGUST, 1947.
by Mr. R. N. FORSTER, H.M. ASSISTANT INSPECTOR OF MINES

Length of Roadway	Result of Analysis Per Cent.		
	Moisture Plus Ash	CO ₂	Incom- bustible Matter
Main Drift from 60 to 110 yds. from oftakes at top :			
Floor	56.1	1.0	57.1
Roof and Sides	82.8	1.0	83.8
Straight East Gate, from 10 to 60 yds. back from face :			
Floor	46.9	2.7	49.6
Sides	64.9	2.2	67.1
Roof	35.3	2.2	37.5
East Motor Bord, from South Heading 50 yds. up gate :			
Floor	25.0	2.5	27.5
Roof and Sides	56.5	1.8	58.3
South Heading, from 2nd East Gate to 50 yds. inbye :			
Floor	51.3	1.2	52.5
Sides	61.0	1.2	62.2
Roof	52.5	0.8	53.3
3rd West Bord, from 10 to 60 yds. from South Heading :			
Floor	23.2	2.0	25.2
Sides	43.9	1.8	45.7
Roof	47.4	0.7	48.1
4th West Bord, from 10 to 60 yds. up from South Heading :			
Floor	22.9	1.6	24.5
Roof and Sides	54.7	0.8	55.5
2nd East Gate, from South Heading 50 yds. up gate :			
Floor	23.0	0.7	23.7
Roof and Sides	39.8	1.8	41.6
5th West Bord, from South Heading 50 yds. up gate :			
Floor	41.7	1.6	43.3
Roof and Sides	19.3	0.7	20.0

(61626) Wt. 1622A-282 3/48 D.L.



LONDON

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. Stationery Office at the following addresses:

York House, Kingsway, London, W.C.2; 13a Castle Street, Edinburgh, 2;

39-41 King Street, Manchester, 2; 1 St. Andrew's Crescent, Cardiff;

Tower Lane, Bristol 1; 80 Chichester Street, Belfast

OR THROUGH ANY BOOKSELLER

1948

Price 1s. 3d. net